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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/760,458	01/21/2004	Taikan Iinuma	OKI.603	1405

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EXAMINER

WILSON, CHRISTIAN D

ART UNIT PAPER NUMBER

2891

DATE MAILED: 07/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/760,458

Applicant(s)

IINUMA, TAIKAN

Examiner

Christian Wilson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 01212004.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: ____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: search history.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1 – 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park *et al.* in view of Noguchi.

Park *et al.* (US 6,465,866) teaches a method of manufacturing a semiconductor device comprising the steps of forming a groove 47 extending from a main surface of a substrate 40 to an intermediate depth [Figure 5B], forming a first thermal oxide film 48 by wet oxidation over a bottom surface of the groove to an intermediate point on the sidewall of the groove [Figure 5C], and forming a second thermal oxide film 54 extending from the intermediate point to over the main surface of the substrate [Figure 5F]. Park *et al.* teaches a second thermal oxide film but does not discuss the oxidation process. Noguchi (US 6,548,866) a second thermal oxide film formed by dry oxidation [column 15, lines 50-55]. It would have been obvious to one of ordinary skill in the art to use the dry oxidation method of Noguchi in the method of Park *et al.* since Noguchi teaches that dry oxidation prevents the formation of a bird's beak and a smaller tilt surface at the side of the trench.

Regarding claim 2, Park *et al.* further teaches forming the groove by patterning using a mask 44 exposing a region of the surface of the substrate and etching using the mask [Figure 5A], forming a pre-first thermal oxide film extending out of the groove and forming an etch

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resistant film **50** covering the pre-first thermal oxide film, performing a second etching to selectively remove the pre-first thermal oxide film extending out of the groove [Figure 5E], and forming the second thermal oxide film while leaving the etch resistant film as an antioxidation film [Figure 5F].

Regarding claim 3, Park *et al.* further teaches prior to the second etching polishing the etch resistant film to expose the pre-first thermal oxide film [Figure 5D].

Regarding claim 6, Park *et al.* further teaches an etching solution containing HF acid [column 6, lines 55-56].

3. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park *et al.* and Noguchi as applied to claim 1 above, and further in view of Kim *et al.*

Park *et al.* as modified by Noguchi teaches the limitations of claim 1 as described above including filling the groove [Figure 5D] and polishing the insulating film **52**, but they do not discuss forming a protection film on the second thermal oxide before filling the groove. Kim *et al.* (US 2002/0117731) teaches forming a protection layer **314** before filling the groove. It would have been obvious to one of ordinary skill in the art to form a protection layer in the method of Park *et al.* since the protection layer alleviates the stress on the inner wall of the trench [0052].

4. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park *et al.* and Noguchi as applied to claim 1 above, and further in view of Chang *et al.*

Park *et al.* as modified by Noguchi teaches the limitations of claim 1 as described above, but they do not discuss the temperature ranges of the dry and wet oxidation methods. Chang *et al.* (US 6,566,224) teaches a dry and wet oxidation method where the wet oxidation temperature is lower than the temperature of the dry oxidation and the temperature ranges from 950 °C to 1100 °C [column 5, lines 10-20]. It would have been obvious to one of ordinary skill in the art

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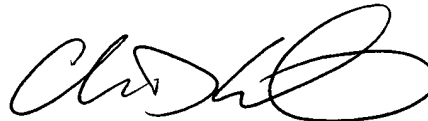
to use the temperature ranges of Chang *et al.* in the method of Park *et al.* since these temperatures are advantageous for forming equivalent oxide thicknesses with reduced sharp corners and leakage current.

Conclusion

5. A copy of the search history is enclosed.
6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christian Wilson whose telephone number is (571) 272-1886. The examiner can normally be reached on weekdays, 7:30 AM to 4 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Christian Wilson, Ph.D.
Primary Examiner
Art Unit 2891

CDW